3D Modeling of Landslide in Open-pit Mining on Basis of Ground-based LIDAR Data

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Slope stability is not only an important problem which is related to production and safety in open-pit mining, but also very complex task. There are three main reasons which affect the slope stability as follows:

- geotechnical factors: Geological structure, lithologic characteristics, water, cohesion, friction, etc.;

- climate factors: Rainfall and temperature; and

- external factors: Open-pit mining process, explosion vibration, dynamic load, etc..

The 3rd reason, as a specially one in open-pit mining, not only causes some dynamic problems but also induces the fast geometry changing which must be considered in the following research using numerical simulation and stability analysis.

Recently, LIDAR technology has been applied in many fields and places in the world wide. Ground-based LIDAR technology with high accuracy up to 3mm increasingly accommodates to monitoring landslides and detecting changing. LIDAR data collection and preprocessing research have been carried out by Department of Engineering Geology and Hydrogeology at RWTH Aachen University. LIDAR data, so-called a point-cloud of mass data in high density can be obtained in short time for the sensitive open-pit mining area by using ground-based LIDAR. To obtain a consistent surface model, it is necessary to set up multiple scans with the ground-based LIDAR. The framework of data preprocessing which can be implemented by Poly-Works is introduced as follows: gross error detection and elimination, integration of reference frame, model fusion of different scans (re-sampled in overlap region), data reduction without removing the useful information which is a challenge and research front in LIDAR data processing. After data preprocessing, 3D surface model can be directly generated in Poly-Works or generated in other software by building the triangular meshes. The 3D surface landslide model can be applied to further researches such as:

- real time landslide geometry monitoring due to the fast data collection and processing;

- change detecting by means of overlying different periods of topographic or geometric data;

- FEM (Finite Element Method) numerical simulation on basis of combining with the geotechnical properties and parameters to analyze slope stability and predict future movements for designing and rectifying the open-pit mining process;

- using the reverse engineering thought for developing constitutive models.

An improved 3D surface model (HRDEM) which is based on fast data collection and precise data processing on basis of ground-based LIDAR technology is important contribution for further researches of slope stability in open-pit mining area.